

STEREO: Organizational Cultures In Conflict

NASA's Solar Terrestrial Probes (STP) Program¹, created by the Office of Space Science, offered a continuous sequence of flexible, cost-capped Missions to investigate the Earth-Sun system. STP Missions used a blend of *in situ* and remote-sensing observations, often from multiple platforms, to study the Sun and Earth as an integrated system. See **Figure 1** for an artist's depiction of the *STEREO* Satellite.

The *STEREO* (Solar Terrestrial Relations Observatory)² Mission was conceived to advance three main program objectives: (1) to understand the changing flow of energy and matter throughout the Sun, heliosphere³, and planetary

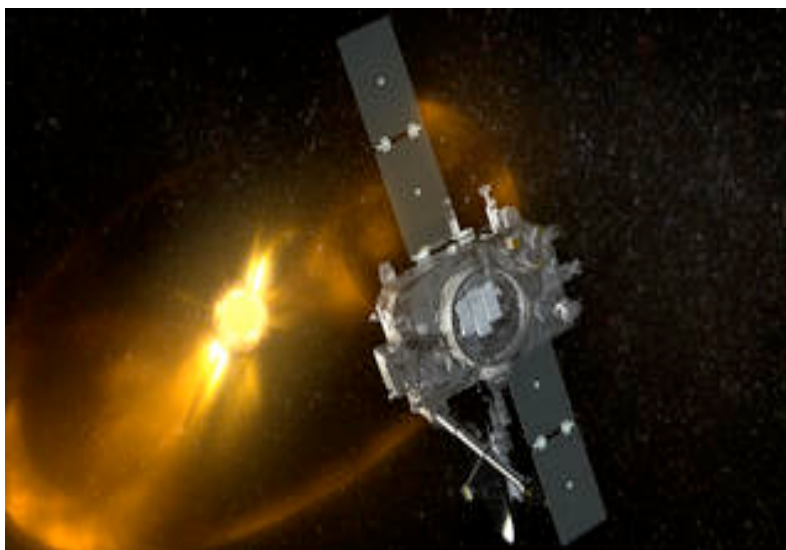


Figure 1: The Loop of a Coronal Mass Ejection Heads Straight toward a STEREO Satellite in this Artist's Conception.
Source: NASA Image.

¹ See **Appendix 1** for the case acronyms.

² See **Appendix 2** for a list of case references.

³ A vast magnetic bubble that includes the solar magnetic field, solar wind, the solar system and beyond.

environments; (2) to explore the fundamental physical processes of space plasma systems; and (3) to define the origins and effects of variability in the Earth–Sun connection.

The *STEREO* Mission

The Goddard Space Flight Center (GSFC) began the *STEREO* Mission in July 1999. *STEREO* was designed to offer a new perspective on solar eruptions by imaging coronal mass ejections and background events from two nearly identical Observatories simultaneously. To obtain unique views of the Sun, the twin Observatories would have to be placed into rather challenging orbits where they would be offset from one another. (See **Figure 2** for an image of the launch configuration.) One Observatory would be placed in its orbit ahead of Earth (*STEREO A*) and the other behind (*STEREO B*). (See **Figure 3** for image of the placement of the Satellites in orbit.) Just as the slight offset between one's eyes provides depth perception, this placement would allow the *STEREO* Observatories to acquire 3-D, stereoscopic images of the Sun. A series of lunar swing-bys would be used to place the Observatories in their orbits. The launching rockets for *STEREO* would swing by the Moon to gain momentum for their destined orbits.

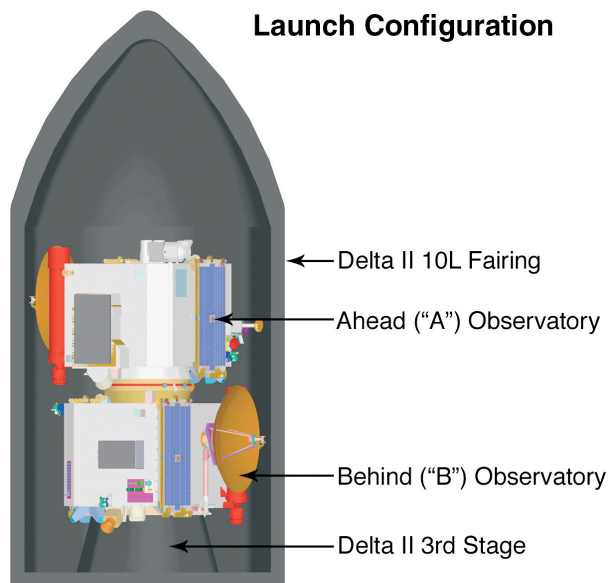


Figure 2: Launch Configuration of the Observatories inside the Delta II Rocket. Source: NASA Image.

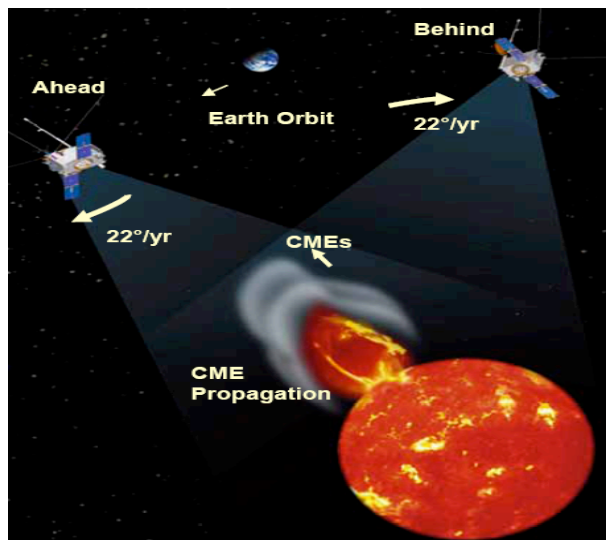


Figure 3: Artist's Image of *STEREO* Observatories, One ahead of Earth's Orbit and One behind. Source: NASA Image.

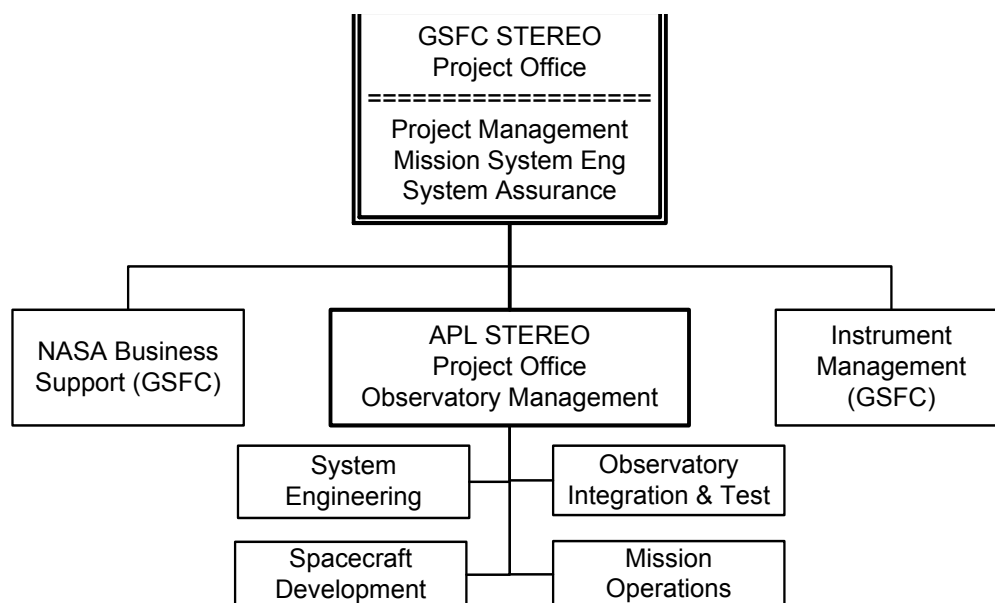
STEREO was the third Mission in NASA's STP Program. It was scheduled to launch in February 2006 on board a single *Delta II* launch vehicle. Each of the twin *STEREO* Observatories would carry two instruments—PLASTIC (plasma and suprathermal ion composition) and SWAVES (*STEREO* WAVES) and two instrument suites—SECCHI (sun earth connection coronal and heliospheric investigation) and IMPACT (in-situ measurements of particles and CME transients). This combination provided 16 instruments per Observatory, including coronagraphs, imagers, burst trackers, plasma sensors, and magnetometers. The total cost for the two-year Mission would be approximately \$400 million for the Spacecraft, instruments, launch vehicle, ground and Mission operations, and data analysis.

Project Organization

Goddard's STP Program Office was managing the Mission, instruments, and the Mission's science center. The Applied Physics Laboratory (APL) at Johns Hopkins University was responsible for designing, building, and operating the twin Observatories for NASA. (See **Figure 4** for *STEREO's* Organizational Chart.) The instruments were being developed and provided by collaborations of university and international partners. APL also designed, built, and operated the first STP Spacecraft, *TIMED* (*Thermosphere Ionosphere Mesosphere Energetics and Dynamics*), which launched on December 7, 2001.

Figure 4

STEREO Organizational Chart



Dealing with Culture

APL's space department culture and values were rooted in the early history of the American space program. APL's Spacecraft history began in 1959; it counted more than 60 successful Missions at the time of the *STEREO* Mission. Many of those involved development and fielding of the first Satellite navigation constellation for the U.S. Navy. Later, APL developed Spacecraft and space instrumentation for a variety of military Missions. For those projects, APL had worked autonomously, with very limited oversight from the sponsors. It thus developed a culture that valued independence, technical performance, and short development schedules (typically three years). APL had also handled a number of NASA-sponsored Missions, including *AMPTE* (*Active Magnetospheric Particle Tracer Explorers*), *ACE* (*Advanced Competition Explorer*), *NEAR* (*Near-Earth Asteroid Rendezvous*), as well as *TIMED*.

The individual Centers and partners comprising NASA Missions typically brought different management models to a Program or Project. This was no different for APL working on *STEREO*. At first, the cultural differences seemed easily surmountable. However, a survey of the Project Team revealed that the issues were more deeply rooted, and worthy of management's attention. Comments (see below) indicated how differences in culture could hinder or prevent success.

Recognizing the cultural issues between Goddard and APL personnel, the Teams of both organizations decided to hold several offsite retreats, including one in May 2004. The core outcome of this retreat was the establishment of an operating agreement (see below) to help the APL and Goddard teams interact as effectively as possible.

Feedback from the Team Survey⁴

GSFC's Comments:

- *"APL seems to place more emphasis on cost and schedule, rather than performance. In more than one instance, they have identified concerns regarding a NASA-proposed implementation, where had they applied the same criteria to their approach, the APL solution would have been found to be inferior. They appear to be willing to accept more risk—basically a 'commercial' mind-set."*
- *"I think that APL's vision is somewhat limited to APL only."*
- *"APL has their own focus again; I don't think it's by any means the same as NASA/GSFC."*
- *"APL needs to accept GSFC/NASA's involvement and move forward as a team. Every member has a place and a role on this Mission."*
- *"Not blaming is VERY hard—almost across the board—in our dynamic with APL. We could use some guidance or coaching."*

APL's Comments

- *"Although we have had times where we appreciate each other's work, the general mood is one of mistrust."*
- *"Because trust has diminished on the Project, we have become very guarded in what we say."*
- *"I believe both the Goddard and APL teams share equal values. I also believe that the values are noble. The breakdown seems only to be limited by what we perceive to be the best path toward achieving a common goal while living within these shared values."*
- *"The distractions of politics, petty disagreements, personal agendas, and unresolved conflicts by both APL and GSFC are destructive behaviors standing in the way of a common goal."*

⁴ These are actual comments excerpted from the survey and are representative of the type of comments received.

- *“Both organizations have a long successful history, but the approaches to those successes have been different. Both organizations are comfortable with their approach. We too often get bogged down in wanting to maintain ‘our’ way.”*
- *“APL has ‘the APL way’ and Goddard has ‘the Goddard way’—each is new to the other.”*
- *“Each organization is very locked into their paradigm of how to execute a Program.”*

The Operating Agreement⁵

General Operating Agreement

“The GSFC and APL STEREO Integration & Testing Teams have a “trusted contractor–customer” relationship:

- *We will operate with a badgeless culture—we are clear about the contractor–customer interface; anyone can accept direction from the appropriate lead.*
- *We will share credit for success and responsibility for failure.*
- *We will trust one another and will work to maintain that trust.*
- *We will operate with clear lines of responsibility.*
- *We will have clear ground rules and open access and communication within those boundaries.*
- *We will work issues at the lowest levels practicable.*
- *We will clearly define the I&T [Integration and Testing] process.*
- *We will jointly define a ‘successful’ test.*
- *We will jointly agree on priorities and work off one master schedule.*
- *GSFC will defend APL to NASA management.*
- *GSFC doesn’t give ‘work direction’—we give information.*
- *GSFC will be at the table during testing—they have open access.*
- *We recognize and respect that both GSFC and APL add value.*
- *We are willing to learn from one another.”*

The Challenge

Having identified the cultural challenge and documented it with the survey, answer the following questions and justify your rationale:

⁵ These so-called “top-line principles” were agreed to at the May 2004 team retreat. There were also more supporting details not supplied here for sake of brevity in the case.

- *How should you respond to the survey results?*
- *How can this feedback from the survey and the operating agreement help you ensure a successful launch and valuable science results?*
- *What would be your actions regarding the culture issues?*
- *What, if any, time and resources would you spend tackling this challenge?*

Appendix 1

Case Acronyms

<i>ACE</i>	<i>Advanced Competition Explorer</i>
<i>AMPTE</i>	<i>Active Magnetospheric Particle Tracer Explorers</i>
APL	Applied Physics Laboratory
GSFC	Goddard Space Flight Center
IMPACT	In-Situ measurements of particles and CME transients
I&T	Integration and testing
NEAR	Near-Earth asteroid rendezvous
PLASTIC	Plasma and suprathermal ion composition
SECCHI	Sun Earth connection coronal and heliospheric investigation
<i>STEREO</i>	<i>Solar Terrestrial Relations Observatory</i>
STP	Solar terrestrial probes
<i>SWAVES</i>	<i>STEREO/WAVES</i>
<i>TIMED</i>	<i>Thermosphere Ionosphere Mesosphere Energetics and Dynamics</i>

Appendix 2

Case References

NASA. *STEREO* Mission Page. Available at:

http://www.nasa.gov/mission_pages/stereo/main/index.html. Accessed on August 21, 2014.

NASA. “Studying the Sun in 3-D.” Available at: http://www.nasa.gov/mission_pages/stereo/spacecraft/. Accessed on August 21, 2014.

NASA. “*STEREO* Sees Complete Far Side.” Available at:

http://www.nasa.gov/mission_pages/stereo/news/farside-060111.html. Accessed on August 21, 2014.